LEARNING OBJECTIVES:

2.11.01 List three purposes of job coverage.

2.11.02 Explain the differences between continuous and intermittent job coverage.

2.11.03 Given example conditions, identify those that should require job coverage.

2.11.04 Identify items that should be considered in planning job coverage.

2.11.05 Identify examples of information that should be discussed with workers during pre-job briefings.

2.11.06 Describe exposure control techniques that can be used to control worker and technician radiation exposures.

☞ 2.11.07 Describe the in-progress radiological surveys that should be performed, at your site, under various radiological conditions.

☞ 2.11.08 Describe site requirements for documentation of in-progress radiological surveys.

☞ 2.11.09 Explain actions that should be taken if surveys show radiological conditions significantly different from that expected.

2.11.10 Describe contamination control techniques that can be used to limit or prevent personnel and area contamination and/or reduce radioactive waste generation.

2.11.11 Describe job coverage techniques that can be used to prevent or limit the spread of airborne radioactive material.

2.11.12 Describe overall job control techniques in maintaining control of radiological work.

2.11.13 State the reasons to stop radiological work activities in accordance with the DOE RCM.

INTRODUCTION

Jobs performed in restricted areas are usually approved and controlled by radiological control personnel by using administrative and procedural controls, such as Radiological Work Permits (RWPs). In addition, some jobs will require working in or will have the potential for creating very high radiation, contamination, or airborne radioactivity areas.

PURPOSE OF JOB COVERAGE

2.11.01 List three purposes of job coverage.

Job coverage by RCTs generally has three purposes:

1. Keep radiation exposures ALARA and within limits and guidelines.
2. Reduce the creation and prevent the spread of contamination.
3. Reduce the creation and prevent the spread of airborne radioactivity.

TYPES OF JOB COVERAGE

2.11.02 Explain the differences between continuous and intermittent job coverage.

Job (or work) coverage can either be continuous or intermittent. During **continuous** job coverage, the technician covers only one job and remains at the job site while work is being performed. For **intermittent** coverage the technician may cover more than one job, performing periodic checks at various work locations.

CONDITIONS REQUIRING JOB COVERAGE

2.11.03 Given example conditions, identify those that should require job coverage.

Some radiological conditions or types of jobs that could require radiological control job coverage are:

- Radiation dose rates in the job area are high enough to potentially cause workers' doses to exceed administrative control levels in a short time.
- Radiation levels are expected to increase significantly during the job.
- Entry into high radiation areas.
- The potential for spreading high levels of contamination or causing airborne radioactivity.
- The potential for significant increase in contamination or airborne radioactivity levels during the job.
- Inadequate personnel dosimetry for the type or levels of expected radiation (e.g., neutrons or low-range dosimeters).
- Jobs performed by inexperienced workers.

PREREQUISITES/WORK PLANNING

2.11.04 Identify items that should be considered in planning job coverage.

To effectively cover a job, technicians must preplan their activities. Items that should be included in the planning include:

- Determine exactly what the workers will be doing (e.g., not just "replace a component" but the details of whether grinding, cutting or welding will be

performed).

- Review old surveys and talk with technicians who have previously covered the same or similar jobs to anticipate any problem areas.

- Review the area and system on which the work will be performed, or talk with the workers to determine the potential radiological consequences of the tasks associated with the job (e.g., opening a cask / container could create contamination, airborne radioactivity, or cause radiation levels to change).

- Ensure that an adequate survey of the job area has been made.

- Review applicable post-job ALARA reviews.

If a sufficient survey is not available, the technician performing the job coverage may have to perform this detailed job site survey before the job begins. This is known as a pre-job survey. These surveys are conducted prior to writing the RWP requirement for a job. This survey should include dose rate, contamination and representative breathing zone air samples for the areas being accessed. The survey should identify the highest and lowest dose rate areas. All individuals, including the technician, should stay in the low dose rate areas as much as possible.

- For jobs in which workers' dose limits could be approached, record the allowable exposure for each worker. A good practice is to have this information available at the job site.

- Establish a method of communicating with the workers during the job.

For most jobs communicating with workers is simply a matter of talking face-to-face. However, for some jobs remote communications (e.g., headsets, or a safety line attached to a belt) may be required. Hand signals may be needed when respirators are worn. Two way portable radios are another option for communication.

- Establish a method of communicating with and transferring samples to the radiological control counting lab.

Often an air sample taken during the job must be transferred from the job site to the radiological control lab for analysis. Arrangements for transferring samples should be made before the job begins.

- Have the appropriate equipment available at the job site.

Examples include extra dosimeters, dosimeter charger, air sampler and filters, a survey instrument, respirator (if needed), watch or clock for time keeping, extra gloves, and any other equipment required by the job.

2.11.05 Identify examples of information that should be discussed with workers during pre-job briefings.

- Pre-job briefing of the workers before going to the job site.

To help improve communications the technician should inform workers of dose rates, contamination levels, and concentration of airborne radioactivity in the work area. This should include an explanation of the probable effect of their job on radiological conditions. Other important points could include method of communications that will be used, specifics about special dosimetry or protective clothing and actions of the technician covering the job. Any worker questions should be answered prior to starting work. The technician should emphasize radiological safety and the importance of following the RWP and it's specific directions.

JOB COVERAGE TECHNIQUES

2.11.06 Describe exposure control techniques that can be used to control worker and technician radiation exposures.

The techniques in covering a job will depend upon the nature of work being done, the radiological conditions present or expected in the work area, and to some extent the experience of the workers. The following sections describe job coverage techniques that may be applicable.

Exposure Control

One of the purposes of job coverage is to keep track of the dose received by workers and suggest methods that the workers can follow to keep their doses ALARA. At the same time, the technicians must take measures to minimize their own dose as well. Pre-job surveys alone are not always adequate in determining the dose rates to personnel during

the job. Many jobs will require that surveys be performed as the job progresses. It is just as important to record the results of job coverage surveys as recording the results of the routine and pre-job surveys. In addition, do not keep this information to yourself or merely log and file the survey records. Keep the personnel in the area informed of the radiological conditions. Technicians should explain to the workers why actions are being taken. The following is a list of some of the techniques that can be used to help maintain exposure control:

- Wait in low dose rate areas while not actually performing the job.

Remember that surveys of job areas should always identify low dose areas. To reduce the amount of time spent in higher radiation levels and consequently reduce the dose received, both technicians and workers should stay in the lower dose rate areas whenever possible (e.g., waiting for equipment, when resting, when visual observation of workers is possible from a distance).

- Periodically read or have workers read their dosimeters.

To keep track of the dose accumulated by the workers the technician should read or have the workers read their dosimeters. If several workers are working on the same job, select one individual to read the others' dosimeters. The individual that reads the dosimeters can remove one outer glove or slip on a clean glove to lessen the chance of contaminating the dosimeters.

- Use workers' allowable dose and the dose rate in an area to determine the length of time a worker can spend in the area.

For jobs where workers will approach an administrative control or DOE limit, the technician will have to determine how long a worker can remain in an area without exceeding the authorized exposure. Detailed surveys will determine the dose rate. The workers dose limits can be obtained from dosimetry records. The following formula is used to determine the amount of time the worker can stay in the area:

$$\text{TIME ALLOWED} = \frac{\text{Allowable Dose}}{\text{Dose Rate}}$$

Remember to tell the individual to leave before the total time has elapsed. It takes some time for the workers to respond and they may receive significant dose going to and from the job location.

- When using time to control workers' dose, an accurate record of the workers location with respect to the dose rate must be maintained.

On some jobs (e.g., working in a neutron radiation field) keeping track of how long the worker is in the radiation field (Dose = Dose Rate x Time) will be used to determine the dose received by the worker. The technician must record the workers' locations with respect to the dose rate to accurately calculate the dose.

- Write down the workers location and time in that location when time keeping.

Relying on memory can be inaccurate. Record the times in the area.

- Observe the location of workers' dosimetry with respect to the location of the radiation source.

On some jobs, the workers' heads, back, or other parts of the body could be receiving higher dose than the chest area where dosimetry is normally worn. Relocating the workers' dosimetry or obtaining additional dosimetry may be required.

- Workers must leave temporary shielding in place unless they have been authorized to remove the shielding by Radiological Control.

Unauthorized movement of shielding could increase the dose rate in the work area.

- Technicians performing job coverage should move temporary shielding only after evaluating the effect of such movement.

- While containers are being removed from a cask, survey as the containers are raised. Don't wait until the containers are withdrawn to make the survey.

- Keep workers from leaning across or over high sources of radiation. Possibly get them to move to the other side of equipment to do their work.

- Prevent workers from picking up sources of radiation with their hands. They should use pliers or tongs, and carry items in a bucket or a plastic bag rather than in the hand.

- Anytime casks, containers or equipment are being opened (or opened further than before) recheck radiation levels, including beta radiation levels.

In-progress radiological surveys

2.11.07 Describe the in-progress radiological surveys that should be performed, at your site, under various radiological conditions.

In-progress radiological surveys that should be performed shall be performed as specified by the controlling technical work document and Radiological Work Permit (i.e.,., smear surveys, dose rate surveys, air samples taken).

(Insert site specific information here)

In-progress radiological survey documentation

2.11.08 Describe site requirements for documentation of in-progress radiological surveys.

Radiological Control personnel shall maintain logs to document radiological occurrences, status of work activities and information that should be communicated to all personnel. Make field notes of survey results for later documentation. Good practice dictates that all surveys should, at a minimum, be documented on the appropriate map.

(Insert site specific information here)

Unexpected radiological conditions

2.11.09 Explain actions that should be taken if surveys show radiological conditions significantly different from that expected.

(Insert site specific information here)

2.11.10 Describe contamination control techniques that can be used to limit or prevent personnel and area contamination and/or reduce radioactive waste generation.

Contamination Control

By observing the actual performance of the job, technicians can suggest methods that could help prevent spreading contamination from one area to another and could lessen the probability of personnel contamination. The following items should be considered:

- Watch the workers. Point out and correct any work habits that could spread contamination.

Even though all workers are trained in basic methods to prevent spreading contamination during their initial Radiological Worker training course, many workers will either forget the techniques or lapse into more familiar but contamination spreading work habits when they begin a job. Such habits include hand-to-face movements, dropping tools, scuffing feet, hammering, and wire brushing. Technicians must identify actions that will spread contamination, ask the worker to stop the action, and explain why the actions should be stopped.

- System components that are being repaired should be wiped down and drained before the system is opened.

Even though operations personnel may have drained a specific part of the system, the workers should have plastic buckets, bags, and plastic sheeting to contain any residual water when the system is opened.

- Ensure that workers follow procedures for transferring material from the radiological area to either a Radiologically Controlled Area or a clean area.

They should hold the bag over the contaminated area, only touch the outside of the bag with clean gloves, place (not drop) items into the bag, not overload the bag, tape sharp edges before placing in bag and not lay the bag down in the contaminated area. Tape the bag shut and mark the bag indicating what it contains. Large items can be covered with plastic sheeting that is taped in place after all surfaces have been wiped off. Wheels on carts, trolleys and cranes can be heavily taped or plastic/paper sheeting laid down between contaminated areas to create a temporary pathway across a clean area.

Do not allow bags of trash, tools or used parts to accumulate in the work area or at the step off pad or control point. Obtain dose rate and contamination surveys of all bagged or covered items being removed from the work area before they are moved when dose rates in the area allow.

- Ensure workers follow proper procedures to minimize contaminating tools and equipment.

By reducing the chances of contaminating tools and equipment, the probability of spreading contamination plus the cost, radiation exposure, and manpower involved in decontamination can be lessened. Techniques such as taping or bagging tools and pulling welding leads, hoses and extension cords into plastic tubing before beginning work or using tools already contaminated should be suggested by the technician. The reasons for the suggestions should be explained.

- Watch for the movement of crane rigging, air or water hoses, electric leads and extension cords into and out of contaminated areas.

- Electrical lines and hoses going into Contaminated Areas should be secured (taped down) to eliminate the possibility of movement in or out.

Any of the above movements could spread contamination. Be alert for such movements and explain why they should not be made. If using cranes is essential, suggest methods to lessen the spread of contamination (e.g., papering floors along the pathway that the crane will take).

- Have workers remove their outer layer of protective clothing (gloves, shoe covers, and coveralls) back away from the step off pad.

- Reduce the creation of radioactive waste.

Reduction of radioactive waste will assist in preventing the spread of contamination and airborne radioactive material and reduce the cost and manpower involved in processing and shipping radioactive material offsite for burial. Before going into the Radiological Area, have the workers remove the packaging for any new equipment they will be carrying into the area. During performance of the job, suggest that a minimum amount of water be used, if required. Point out to the workers other areas where creation of radioactive waste can be reduced.

- Control the removal of equipment from work areas.

As soon as possible obtain a dose rate and contamination survey of any equipment being

removed from the work area. Do not allow bags of trash, tools, or used parts to accumulate in the work area.

2.11.11 Describe job coverage techniques that can be used to prevent or limit the spread of airborne radioactive material.

Airborne Radioactivity Control

If the creation and spread of airborne radioactivity can be reduced, the use of respiratory protection equipment can be lessened. By watching workers and monitoring for airborne radioactivity during a job, technicians can suggest methods that can prevent creating airborne or warn workers when airborne radioactivity is present. Appropriate corrective actions (e.g., respiratory protection, evacuation of work area, stay times) can be implemented. As in exposure and contamination control, the technicians should explain the actions required to the workers. The following items should be considered:

- Look for any actions that could create airborne radioactivity.

Such actions could include opening systems containing radioactive material; leaks or sprays from the system, welding, grinding, cutting on contaminated systems; or any actions that could disturb highly contaminated surfaces (e.g., hammering, wire brushing, or use of pneumatic tools). Warn the workers and take appropriate corrective actions.

- Take air samples during jobs in highly contaminated areas or at steps (e.g., opening a system to change HVAC filters) that could create airborne radioactive material during a job.

During the performance of such jobs, workers will usually be in respirators as a precautionary measure. Analysis of the air sample can be used to determine the necessity of respirators and to calculate the number of DAC-hours received by the workers.

Remember to get the sample counted and obtain the results as quickly as possible. A grab air sample only tells you what the average airborne radioactivity concentration was in the area while the sampler was running.

- Use a continuous air monitor (CAM) during performance of a job that is likely to create airborne radioactivity.

CAM results give an immediate indication of an increase in the airborne radioactive material concentration. Appropriate protective action for CAM alarms includes evacuation of all affected personnel and notification of Radiological Control. Re-entry into affected areas should include the use of respiratory protection.

- Ventilate enclosed areas.

By ventilating enclosed areas, airborne radioactive material generated in the area can be removed. "Enclosed areas" include permanent cubicles or rooms or temporary tents built to enclose work areas. Ventilation can be obtained via the installed in-plant ventilation system or by using portable fans or blowers with HEPA filters.

2.11.12 Describe overall job control techniques in maintaining control of radiological work.

Overall Job Control Techniques

In the preceding three sections, the specific guidelines for controlling exposure, contamination and airborne radioactive material were discussed. In addition to maintaining control over these three specific areas, technicians must maintain overall control of the radiological aspects of the job.

- Establish worker trust and confidence.

Worker trust and confidence are not automatically gained by being the RCT covering the job. Trust and confidence must be earned by each technician and the entire plant radiological control staff. Characteristics of technicians and health physics departments that will assist in earning worker trust include being reliable, credible, realistic, and consistent.

- During job coverage, the technicians should keep workers within their line of sight, if possible.

While not possible at all times (e.g., when workers and technician are separated by a shield wall), the technician should constantly be observing the workers. Poor work habits possibly leading to the spread of contamination, creation of airborne radioactive material, and unnecessary exposure to radiation can be identified and corrected.

- Keep in contact with the workers.

The technicians should talk with the workers to remind them that they are covering the job and are available to answer questions or make suggestions. This is especially important if remote communications equipment is being used, since the workers may be apprehensive.

- Remind workers that casks, containers or systems are not to be opened or work techniques changed without notifying radiological control.

Explain that these actions could change radiological conditions in the area and cause unnecessary exposure to radiation or airborne radioactive material or cause the spread of contamination.

- When an individual's work habits must be corrected, offer the correct method as advice or help.

No worker enjoys being told that his method of doing a job is incorrect. A belligerent, demanding approach by the technician can result in more harm then benefit. Explain why the workers' method is incorrect and what the possible consequences are and then offer the correct method as another solution. Remember that as a technician your role is to assist the workers in maintaining their exposures ALARA.

- Maintain interest in the job being performed.

If workers note that the technician is complacent or disinterested in the job, the workers may become lax in following the proper procedures for reducing their exposure and preventing the creation and spread of contamination or airborne radioactive material. The technicians covering the job should take an interest in the job being performed by the workers and take pride in their own work.

- Do not overreact to situations when there is time for levelheaded solutions. Getting excited and yelling at workers for minor problems will only result in the workers losing any respect for the radiological control staff. Calmly explain what the problem is and the steps that need to be taken to correct the situations. Reserve excitement for true emergencies.

2.11.13 State the reasons to stop radiological work activities in accordance with the DOE RCM.

Stop Work Authority

- The DOE RCM gives Radiological Control personnel the authority and responsibility to stop work when there are:

  - Inadequate radiological controls
  - Radiological controls not being implemented
  - Radiological hold points not being satisfied
  - Alarming dosimetry or unexpected dosimetry readings

- Exercise your authority to stop work with discretion. Remember it is your responsibility to ensure that the work is performed safely in a radiological environment. The following situations are examples of when work should be temporarily halted to correct problems:

  - Workers disobeying procedures or not following their RWP
  - Dropped container incidents / spills
  - Unexpected dose rates or surface contamination readings.

- Resumption of radiological work requires approval from the line manager responsible for the work and the Radiological Control Manager.

SUMMARY

This lesson addressed radiological work coverage. The areas covered included the conditions requiring job coverage, the prerequisites and planning involved, and techniques associated with the coverage of radiological work.

REFERENCES

1. Radiological Control Manual, DOE/EH-0256T